

20. *Anæa andria* Scud.—Common; April to November. Two broods, possibly three; the imago hibernates. Food-plant, *Croton capitatum*.

21. *Debis portlandia* Fabr.—Rare; two specimens in July. Probably two broods; the larva probably hibernates. Food-plant, grass.

22. *Neonympha gemma* Hüb.—Common in dense woods July to September. Three broods; the larva probably hibernates. Food-plant, grass.

23. *N. eurytris* Fabr.—Common; May to July. One brood, possibly two; the larva hibernates. Food-plant, grass.

24. *N. sasybius* Fabr.—Rare; July to September. Two broods; the larva hibernates. Food-plant, grass.

25. *Libythea bachmani* Kirtl.—Abundant; June to October. Two broods, possibly three; the imago probably hibernates, early specimens being worn. Food-plant, hackberry.

(To be continued.)

### SPHERULARIA BOMBI IN AMERICA.

An animal in which *Prolapsus vaginæ* is normal.

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Prof. John B. Smith recently sent me some parasites (*Spherularia bombi*) from the body-cavity of the Humble-Bee for determination and requested me to write a short account of them for publication in ENTOMOLOGICAL NEWS.\* I acceded to the request all the more willingly as, so far as I have been able to find, this curious parasite has never been described in American literature, although several records of the presence of a parasite in the Humble Bee occur in American journals which undoubtedly refer to this particular species.

The parasite in question is one of those curious forms in which, what frequently occurs to a moderate degree as a pathological process in higher animals, here takes place to an enormous extent as the normal condition of affairs; it is further an extremely interesting form, as a particular set of organs normally undergoes an hypertrophy entirely out of proportion to its original size, or in fact to the size of the original organism. A third point in connection with the worm is that it represents one of those peculiar cases of parasitism in which only the female sex lives a parasitic life.

\* I found specimens in material collected by my students in female *Bombus pennsylvanicus*, *B. fervidus* and *B. consimilis*.





SPHERULARIA BOMBI.







The worm was discovered, in 1838, by Léon Dufour, who was inclined to look upon it as an insect-larva. Von Siebold, however, afterwards showed that true nematodes develop from the egg of this monstrosity, and its systematic position was thus made somewhat more clear. The worm was then observed by various workers, but no clear explanation of the paradoxical organism could be given. Lubbock afterwards noticed that an almost microscopic nematode was frequently found attached near one end of the parasitic structure, and Schneider suggested that the larger tube-like structure was an organ which had become more or less independent of the original body. Prof. Rudolf Leuckart\* (1887), to whom science owes the solution of so many of the riddles which confront the helminthologist, finally made a very thorough study of the worm, together with another worm, showing the same tendency to a somewhat lesser degree, and succeeded in clearing up this gynecological mystery.

The following is an abridged account of the parasite, and those who desire to examine more closely into the details of the subject are referred to Leuckart's magnificent monograph.

The males and females of *Spherularia bombi* are almost microscopic; they live in moist earth and, although their intestinal system is not of such a structure as to allow of their taking food, they may live for months, probably using the reserve material stored up during their inter-uterine existence. Their reproductive organs come to functional development and the animals copulate; after copulation the males die, the females alone living to represent the species.

The females then watch their chance to obtain a "widow's home" for the Winter; they enter the female Humble-Bee which is about to hibernate, and in the body-cavity of this insect they continue their curious development. The vagina gradually evaginates through the vulva, taking with it the entire sexual apparatus, and the greater part of the intestine; this evaginated portion develops to an enormous extent, attaining in many cases 20 mm. in length by 1 mm. in breadth, but remains attached for a long time to the almost microscopic body of the original worm at the vulva, or possibly it would be better to say that the body of the female remains attached at the vulva to its evaginated

\* 1887—Neue Beiträge zur Kenntniss des Baues u. d. Lebensgeschichte der Nematoden; Abh. d. math.-phys. Cl. Kgl. Sachs. Ges. d. Wiss. pp. 565-704, 3 Taf.



genitalia! Finally, the body of the worm falls, and the genitalia continue to live an independent existence, nourished by osmosis in the body-cavity of the bee. It is estimated that the genitalia have hypertrophied 60,000 times their natural size, and have become 15,000 to 20,000 times the size of the original female.

In the meantime numerous embryos have developed within the uterus; these embryos fall into the body-cavity of the bee and become free, probably boring through the intestinal wall of the host and being passed, or in some cases by the death and decay of the bee. Upon becoming free, they develop their sexual organs and copulate, the males die and the females await the opportunity of obtaining a Winter home in the next Winter's female humble-bees.

It is almost needless to add that the presence of these parasites, especially in large numbers, brings about an atrophy of some of the organs, more particularly of the internal genitalia of the host, and this causes the female bees to remain more or less sterile.

The parasite described (*Spherularia bombi*) does not represent the only species of nematode in which we find these gynecological conditions. Leuckart has described a parasite (*Atractonema gibbosum*) from the body-cavity of the larva and pupa of a small *Cecidomyia* which has a similar life-history, but in which the *prolapsus vaginæ* occurs to a more moderate degree. I have also frequently noticed *prolapsus vaginæ* in the genus *Oxyuris* (pin-worms) more particularly in *O. ambigua* Rud., 1819, found in rabbits (*Lepus cuniculus*). This condition, which is not infrequently noticed in the worms found in the intestines, can be brought about artificially by suddenly immersing the parasite in cold water.

#### EXPLANATION OF PLATE XI.

Fig. 1.—Normal young worm.

" 2.—Female with beginning evagination of the vagina.

" 3.—The evaginated vagina has grown larger than the worm and contains the other genital organs and the intestine.

" 4.—*Spherularia bombi* as usually found. The body of the worm has fallen.

" 5.—Transverse section through fig. 4.

Figs. 1-5 are taken from one of my old Leipzig sketch-books, and figs. 2, and 5 at least, and possibly also fig. 3 were made from Leuckart's original preparations.

Fig. 6.—*S. bombi* with the body of the worm still attached. After Lubbock, from Cobbold.

All figures greatly enlarged.